TUNABLE SOLID-STATE LASER TECHNOLOGY FOR APPLICATIONS TO SCIENTIFIC AND TECHNOLOGICAL EXPERIMENTS FROM SPACE

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Current Agency plans for the NASA Earth Observing System (Eos) include development of a lidar facility to conduct scientific experiments from a polar orbiting platform. A recommended set of experiments to meet the Eos scientific investigations has been scoped by the Laser Atmospheric Sounder and Altimetry (LASA) panel, which includes techniques of atmospheric backscatter (Lidar), Differential Absorption Lidar (DIAL), altimetry, and retroranging. For the DIAL experiments, which include measurements of the vertical profiles of water vapor, pressure, temperature and ozone, tunable lasers are required with fairly stringent performance requirements on average power, spectral purity, stability and tunability over a broad range of the electromagnetic spectrum. These requirements have been scoped by the LASA panel members.

Additionally, preliminary assessments of the resources (power, weight, volume) required by the Eos Lidar Facility have been conducted. These assessments included trade-off studies between various telescope diameters, laser transmitter technologies and optical receiver systems. An obvious approach to reduce the weight, power and volume required from the Eos space platform is to incorporate elements of the newly emerging tunable solid state laser technology.

In response to Eos and other technological needs, a research program in tunable solid state laser technology has been developed at the NASA Langley Research Center. This research program includes laser materials development, modeling and experiments on the physics of solid state laser materials, and development of solid state laser transmitters with a strong focus on Eos scientific investigations. In this paper, we will discuss some of the system studies that have been conducted which highlight the payoff of solid state laser technology for the Eos scientific investigations. Additionally, a summary of some promising research results which have recently emerged from our research program will be presented, and will be used to project the future research and development program required to bring this promising technology to fruition for the Eos era.

Although an important goal of the solid state laser research program is for the development of tunable laser technology for the Eos lidar facility, there are other important applications, including the NASA Global Tropospheric Research Program and interesting technological experiments from the Space Shuttle and NASA high flying aircraft. Comments will be offered in this presentation on some future possibilities in technological experiments that can be conducted on these platforms.